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COLLABORATION BETWEEN INFORMATION ANALYSIS CENTERS AT A LARGE MULTIPURPOSE LABORATORY

Francois Kertesz

Information centers working on related areas developed a pattern of cooperation. The presence of many centers at the same location ensures a better service to the users; in addition, their activity helps management in the reorientation of research programs. The paper has been presented at the Symposium on the Handling of Nuclear Information, sponsored by the International Atomic Energy Agency on February 16 to 20, 1970 in Vienna.

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COLLABORATION BETWEEN INFORMATION ANALYSIS CENTERS AT A LARGE MULTIPURPOSE LABORATORY

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During the last decade a relatively new type of scientific information-handling agency appeared on the scene: the information analysis center. Its roots are embedded in the tradition of the nineteenth-century scientists, such as Beilstein and Gmelin, who accepted the challenge to bring some kind of order into the ever-increasing flood of data, to make experimental findings conveniently available to other scientists.

It took a long time before the centers reached their present form; the centers keep changing even today, and their activities differ widely. They have not yet reached the relatively stable plateau of primary journals and abstracting/indexing services. Microfilm publishing, computerized searching methods do affect these "mature" agencies also, but their basic operation remains unchanged. On the other hand, the information centers are at an active stage of their development. Many centers have been established lately in a variety of locations, but they have to struggle for survival. At times of budgetary difficulties, they are among the first ones to feel the pressure; tradition of age and prestige are not yet helping them to withstand the effects of occasional poor management or shifting emphasis in the national science policy.

As a result of this, we have had the opportunity during the last few years to observe the creation and demise of information centers and to discern some of the factors which affected the selection of the host agency, interaction of the centers with local technical activities, and their cooperation with other groups on the national or international level.

I would like to examine the relation of information centers with the agencies which provide a home for them. Centers have been established as an adjunct to special libraries, or central document-handling groups of government agencies. Because of this, technical men often confuse "information handling" with "document handling" and overlook the emergence of a new function: critical examination of the contents. The basic criterion is relatively simple: in true information analysis centers, the output is not the same as the input. Document centers often use sophisticated computerized search and retrieval systems, but in the end the answer to queries consists of a list of more or less relevant articles. On the other hand, in an information center the material is filtered through a human brain: the knowledge contained in the papers is evaluated, the numerical values are adjusted if deemed necessary; the answer to a question is a composite of the literature and the expert's opinion. Of course, human bias cannot be avoided, but the answer is straightforward and to the point.

Thus, in my opinion, isolated specialized libraries and document-handling centers are not well suited to house a true information analysis center; a closer daily contact with ongoing scientific activities is needed. Indeed, many centers grew out of another important information-transmission tool – the primary journal. Traditionally, editors of technical

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journals are working scientists. The staff of the Oak Ridge National Laboratory has fulfilled this obligation toward the scientific community and has accepted the responsibility for editing several primary journals and review organs; several information centers have been established by the editors, who had to keep up with recent developments within the scope of their journals.[1] The editors also maintain a list of nationally recognized experts in their area of interest who serve as referees. This list is an excellent basis for another new information tool, the referral center – to obtain advice from the "man who knows."

Information centers have also been located at narrowly specialized institutions, supplementing the experimental work of the host organization. As a general rule, this arrangement strengthens the work program by ensuring that the staff is aware of new developments.

I propose more closely to examine the analytical centers established at a large multipurpose laboratory. At present several large institutions provide a congenial home for information centers. There are about 16 centers at the Columbus Laboratories of Battelle Memorial Institute; the National Bureau of Standards houses more than a dozen centers, most of which are sponsored by the National Standard Reference Data System. The Oak Ridge National Laboratory accommodates more than a dozen centers; the exact number is difficult to pinpoint because information centers, like other biological or social organisms, are born, then may prosper, or wither and die.[2]

The presence of so many information centers supplements the program of the Laboratory, and should the need arise to focus attention on other fields, the centers are useful to help to develop new programs. This is an important consideration because one of the most important duties of management is the eventual reorientation of the program of the institution. Examination of the interaction between top management and groups of information centers is one of the subjects of this paper. In addition, I propose to study how a group of centers, located at the same large multipurpose institution, collaborate with each other.

In order to better understand the problem, it might be of interest to describe the mission of the Oak Ridge National Laboratory. Originally a branch of the wartime Metallurgical Laboratory of the University of Chicago, it housed the first nuclear reactor to operate at power. The main goal was to obtain data for the design of the Hanford production reactors and to produce enough plutonium to operate pilot plants for developing the separation process. The increasing number of specialized teams of reactor, chemical, and other engineers and scientists ultimately covered many branches of science and technology – from health physics to metallurgical engineering. Subsequent developments extended into areas of pure science, but the Laboratory's overall commitment remained the solution of problems of national importance.

The concept of the national laboratory as a new expression of pure and applied research has been outlined by ORNL Director Alvin M. Weinberg, who emphasized the difference with respect to the university and industrial laboratory:

> *The National Laboratory is par excellence interdisciplinary and mission-oriented....So we see the pattern: far-out ideas hardly economical at the time they are conceived, being developed first in the National Laboratories and then moving to industry.*[3]

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[1] Several such journal-generated information centers are mentioned in the author's paper *Information Centers at the Oak Ridge National Laboratory (a Study in Diversity)*, ORNL-TM-996, November 13, 1964, pp. 3–4.

[2] Examples of proposals for new information centers and the demise of existing ones are given in an internal memorandum of the author.

[3] Fourth Nuclear News Panel, 1967 Winter Meeting of the American Nuclear Society, Chicago, Illinois.

The actual program of the Laboratory did and does undergo changes as a result of various political and technical factors. But these changes must be channeled and directed. To quote again the words of Dr. Weinberg:

> *There is danger, in the rush to deploy, that we will lose sight of some of the most exciting and worthwhile projects that flow most naturally from the historical concern of existing laboratories and existing missions.*[4]

This is the host agency: a large institution, created under wartime conditions to solve an urgent specific problem, being involved currently in the adjustment of its program. As far as specialized information activities are concerned, it is also the home of the following information analysis centers:

Accelerator Information Center

Atomic and Molecular Processes Information Center

Charged-Particle Cross Section Information Center

Information Center for Internal Exposure

Isotopes Information Center

Nuclear Desalination Center

Office of Saline Water – Materials Information Center

Actinide Research Information Center

Biogeochemical Ecology Research Collection

Environmental Mutagen Information Center

Nuclear Data Project

Nuclear Safety Information Center

Radiation Shielding Information Center

Research Materials Information Center

The centers are under the scientific supervision of the various research divisions; the writer provides coordination on behalf of Laboratory management. This arrangement provides a close integration of the information activity with the research work; the remaining technical staff, even though not formally assigned to a given center, is available for consultation.

The centers are not part of a formal network, as are for example the constituent groups of the Neurological Information Network of the National Institute of Neurological Diseases and Blindness, or the centers sponsored by the National Standard Data Reference System. In both cases, there is a master plan or a formal charter, and an attempt is made to cover the designated area of science systematically, widening the scope of the activity as the budget permits.

The ORNL centers have not been created on that basis; the competence of the personnel and the research interest of the Laboratory were the chief criteria for defining the scope of the centers. Therefore, they present an interesting example of relatively free interaction with each other and with the overall research program. Let us examine how this works out in practice.

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[4] Redeployment of the Atomic Energy Laboratories, presented before the Research Management Advisory Panel of the Daddario Subcommittee on Science, Research, and Development, U.S. House of Representatives, Washington, D.C., September 25, 1967.

First, there are organizational problems to consider. The loosely coordinated centers are directly supervised by the research divisions, which are responsible for the technical excellence of their work; at the same time, they are part of a major laboratory with better than average technical information services. The Technical Information Division has about 150 employees, and its activity encompasses every aspect of a scientific paper from its generation to its storage and ultimate use. The Technical Publications Department provides editorial assistance to authors; the Graphic Arts and Photography Departments make the necessary illustrations, and the whole report is printed by the Reproduction Department. Similar assistance is lent to authors who submit papers to outside journals or compilations. The Laboratory Records Department makes the distribution, keeps track of copies, and handles the reprints, while the Documents and the Reference and Circulation Sections of the Technical Libraries make the books and reports available to the staff.

The information analysis centers are of course major users of these services. In order to facilitate access to them, the Library has designated a coordinator. Thus, the centers do not have to be concerned with how to procure books, subscribe to journals, or obtain translations; the coordinator directs the requests to the involved professionals.

Another very important factor contributed to the successful operation of the whole group of centers in Oak Ridge: the presence of the Computing Technology Center. This organization provides computing services to all AEC-owned plants and laboratories operated by the Union Carbide Nuclear Division.[5] The Information Systems Department, and more particularly its Information Retrieval Section, collaborated closely with one of the centers, the Nuclear Safety Information Center, and developed for it a storage and retrieval and an SDI system. The program was later adapted to the needs of the Nuclear Fuel Technology Information Center,[6] the Nuclear Desalination Information Center, the Office of Saline Water – Materials Information Center, the Machining and Gauging Information Center,[7] and the Isotopes Information Center. The costly duplication of software development expenses has been thus avoided, and all of the centers draw great profit from the availability of a computing service specialized in the information-handling field.

Now, I would like to examine one of the centers more closely, in order to illustrate the informal collaboration between them. This will be followed by reviewing the effect of information centers on the overall program of the Laboratory during a period of reorientation.

As an example, I selected one of the major ORNL centers, the Isotopes Information Center (IIC). As outlined by its director during a panel discussion at the American Nuclear Society's 1966 Annual Meeting in Denver, Colorado: "...the broad scope of the center includes anything that has to do with the production and use of isotopes, with strong emphasis on applications in industry and research, and current awareness of related applications in biology, medicine, agriculture and education...."[8]

The center prepares state-of-the-art reviews and critical studies of these areas, many of which are presented in the quarterly review journal *Isotopes and Radiation Technology*. Specific queries are answered by subject specialists.

As the scope of the center is quite broad, the requests for information often may go beyond the boundaries set by management. After all, the users cannot be expected to be aware of the exact boundaries of the coverage of each center; they usually prefer to deal

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[5] Additional computing services are also available at the Mathematics Division of ORNL.

[6] At present, this center is not in operation.

[7] MAGIC is functioning at the Y-12 Plant of Union Carbide Nuclear Division.

[8] P. S. Baker: Isotopes Information Center, TID-22972, pp. 15–25, USAEC, Division of Technical Information.

with an agency with which they are already acquainted. Thanks to the collaboration between centers, assistance may be rapidly obtained from one of the local groups. This collaboration may be illustrated on the basis of questions legitimately directed to IIC, without attempting to cover its manifold activities completely.

Let us first consider some examples which fell completely within the scope of the center and could be answered from its own resources.

A graduate student in ecology requested information on tracking small animals with discrete-source radioisotopes. Only literature references were sent to the requester; however, upon further study the subject appeared to be of general interest, and as a cursory search failed to reveal significant review articles, the literature was extensively examined. The findings were summarized in a paper published in an international journal.[9] The staff's guess about the interest in the field appeared to be correct: about 200 reprint requests were received.

Other typical requests were concerned with the measurement of ventilation rates, determination of the rate of wear of alloys, efficiency of detergents, etc., using radioactive tracers. The Center's collection of pertinent journal articles, books, government reports, etc., enabled the staff to respond satisfactorily. Quite often, the question had to be handled on a highly individualized basis, as though by a specialized consultant.

However, there are definite limits to the expertise available in a small group and to the coverage of a specialized collection. The staff was unable to satisfy a question by a nuclear physicist which involved the decay scheme of a nuclide. The IIC members were trained mostly in the field of chemistry and chemical engineering, and they were not sufficiently familiar with the fine points of nuclear physics. In spite of this, they were able to answer the query by asking the assistance of the Nuclear Data Group, which specializes in this field. The background in nuclear physics of these physicists beautifully supplements the chemical expertise of the IIC staff.

The collection of the Isotopes Information Center covers only some specific properties of the actinide elements. Material is available on the use of californium in neutron radiography, but a question on the separation of californium formed in an irradiated plutonium target would have to be referred to the Actinide Research Information Center, which is currently organized under the auspices of the Chemical Technology Division of the Laboratory.[10] Should the query relate to the synthesis of that element or its chemical properties, the researchers of the Transuranium Research Laboratory of the Chemistry Division are available to provide expert help.

Because of the very nature of the work involving radioisotopes, problems related to the physical handling of radioactive materials are often encountered; the queries received reflect this concern. The scope of IIC does not cover this field, but various aspects of this important secondary problem could be covered by one of the other local centers.

Questions related to safety aspects are answered by consulting with the Nuclear Safety Information Center, operated by the Reactor Division. Among other areas, this center is concerned with the containment of nuclear facilities and is able to examine problems related to consequences of accidents such as an explosion within a hot cell or release of activity into the environment from a confined volume. Although the material relates primarily to reactors, the knowledge gained is of great interest to isotope producers and users. The center

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[9] Martha Gerrard, "Tagging of Small Animals with Radioisotopes for Tracking Purposes: A Literature Review," *Intern. J. Appl. Radiation Isotopes* 20, 671–76 (1966).

[10] The exact status of this center depends on the current budgetary situation.

is also concerned with the routine release and monitoring of activity through waste effluents.

Design and related calculations for the shield of a hot cell fall within the purview of the Radiation Shielding Information Center. That center, established within the Neutron Physics Division, analyzes the literature pertaining to the shielding of reactors, accelerators, and radiochemical plants. Its Computer Code Collection is unique; it carefully evaluates computer programs developed all over the country, and makes them available to the technical community. This activity rescues a valuable and expensive national resource from oblivion.

The question may arise, What is the actual effect of radiation which in spite of all efforts of confinement reaches a human organism behind the shield? Such questions are examined primarily within the Health Physics Division. This is logical because study of the radiation levels in working areas where the health of the personnel is endangered lies within the jurisdiction of health physicists. An example of the close attention with which the Radiation Shielding Information Center follows the related work of the Health Physics Division's scientists is presented in the August 1969 issue of the RSIC Newsletter. A study by two scientists of the Health Physics Division for converting neutron flux to a dose rate[11] has been referred to by RSIC staff members, who used it as a basis for proposing a new name for the calculated maximum dose.[12]

Another information activity of the Health Physics Division, the Information Center for Internal Dose, covers another area, indicated by its name, which may be involved occasionally in queries to the Isotopes Information Center. The field of interest of the Information Center for Internal Dose covers the effect of ingested radioactive materials within the organism on the basis of mathematical models. This work involves integration of the available research data, which are widely scattered; it culminates in proposals for maximum permissible concentrations in the environment for each radionuclide.

The Health Physics Division is equipped to provide additional expert backup on environmental problems. The Radiation Ecology Section of its Environmental Studies Department maintains the Biogeochemical Research Collection, which is currently in the process of being developed into a full-fledged information analysis center. Researchers of that group are able to examine the problems from the viewpoint of a large environment.

Let us continue our examination of requests that could be directed to the Isotopes Information Center. Study of radioisotopes is closely related to that of high-purity materials, and the IIC is apt to receive queries about techniques connected with the preparation and properties of ultrapure substances. Even in that case they are able to obtain assistance within the Laboratory. The Research Materials Information Center of the Solid State Division collects material on crystal growth methods, purification techniques, analytical determination of purity, and physicochemical properties of ultrapure inorganic material; much of the collected material is applicable to isotopes.

The above examples hopefully illustrate some of the strength derived from the presence of a group of information analysis centers at the Oak Ridge National Laboratory. Let us now examine the advantages derived from this fact by management.

As mentioned previously, plans are being readied to redeploy the Laboratory's resources in the area of environmental studies.

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[11] W. S. Snyder and J. Neufeld, "On the Passage of Heavy Particles Through Tissue," *Radiation Res.* **6**, 67 (1957); also in NBS Handbook 63.

[12] H. C. Claiborne and D. K. Trubey, "Gamma-Ray Dose Rates in a Slab Phantom," *Trans. Am. Nucl. Soc.* **12**(1), 383 (1969); also ORNL-TM-2574.

When the Laboratory is embarking in new fields of broad national interest, the state of the available techniques must be carefully analyzed by drawing on a variety of sources. In a recent report on "Technology: Processes of Assessment and Choice"[13] it was stated: "What is needed, clearly, is a wide diffusion of deeper understanding about technology and deeper concern about its implications." The report further recommends (p. 92) that an information center on technology assessment be established to support systematic inquiry in this field. Such an activity could be conveniently organized from among the scientifically trained information specialists already employed at the Laboratory.

And so, the bread cast upon the waters returns. The strong support provided by the Laboratory to information analysis activities absorbed a sizable amount of money but created a strong set of information and data centers and helped to maintain experienced document-handling experts and specialized computer programmers with experience in systems development. Should the Laboratory indeed become strongly involved in large-scale environmental problems, it is in the fortunate position of already having a nucleus of information activity in this area, as exemplified by the Biogeochemical Ecology Research Collection and the recently created Environmental Mutagen Information Center, co-sponsored by the Environmental Mutagen Society and the Consumer Protection and Environmental Health Service. The Applied Health Physics and Safety Department, which measures and stores personal monitoring data, possesses a staff with specialized data-handling ability.

Data handling in environmental sciences requires techniques which differ from those usually encountered in the experimental field: by their sheer volume, the observational data challenge the ingenuity of the storage systems designer. The so-called raw data must still be evaluated before storage to provide some information about their reliability and precision. Through the Information Center Coordinator, the Laboratory is maintaining liaison with COSATI Panel No. 6 on Information Analysis Centers, keeping up with new techniques developed by the centers of large environment-oriented agencies, such as NASA and ESSA. Coordination between these large collections is essential, as it is not necessary that all of the data required for the proposed future project be collected and maintained at the Laboratory itself.

It might be of interest to point out that the proposed reorientation is based on past experience. Establishment of large environmental agencies at the Laboratory would be based on expertise acquired during earlier studies. I would like to cite a few examples:

1. Interdivisional teams have for years monitored the activity of the waters downstream from the Laboratory – White Oak Lake, the Clinch River, and a portion of the Tennessee River system itself. This work culminated in a well-known and comprehensive report study.[14]
2. Members of the Civil Defense Project have been involved for several years in the analysis of sociological data.
3. The air monitoring network, established both near the Laboratory and at more remote sites, yields large amounts of numerical data and contributed at an early stage to the development of storage and retrieval techniques.

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[13] Report of the National Academy of Sciences, prepared by the ad hoc Panel on Technology Assessment, created by the Committee on Science and Public Policy, Harvey Brooks, Harvard University, Chairman, Committee on Science and Astronautics, U.S. House of Representatives, July 1969.

[14] *The Clinch River Study,* edited by R. J. Morton; first of six reports: ORNL-3119 (1961).

The Laboratory is thus in an excellent position to establish "archival" data collections, placing them at the disposal of the interested scientists and using the available talent for interpretation.

To summarize: The Laboratory supports a large analytical activity in the information field, supplementing its impressive regular Technical Information Division. The centers serve the worldwide technical community in their area. The Laboratory's direct benefit from this effort is relatively small – it is due mostly to the physical closeness of the centers, which makes it relatively easy for staff members to obtain the needed information.

However, there is another, indirect benefit. By providing a congenial home for a large number of specialized information analysis centers, the management has at its disposal articulate subject specialists who are also trained in the new disciplines of information handling and modern search techniques. These scientists and engineers critically evaluate the material turned up by their search and then provide a synthesis of their findings on the basis of their professional personal experience.

This is especially important when the institution is trying to reorient its goal, as the Oak Ridge National Laboratory is now doing.

In a recent interview, Weinberg emphasized that Oak Ridge's mission is still nuclear but it is diversified: "While institutions are immortal, the validity of their mission is not immortal. An institution such as this has a profound role as a multidisciplinary organization to make use of this wealth of disciplines for the good of mankind. This is what we are trying to do."[15] Support of information activities helps to achieve this goal.

Close interaction between management and information activities also helps to control the quality of the scientific output. The new director of the National Bureau of Standards, Dr. L. M. Branscomb, has stated that one of the chief benefits derived from the National Standard Reference Data Systems consists in the improved quality of the numerical values. Although the data compilations are of great interest to the technical community, they present the additional benefit of quality control derived from the evaluation process itself.

Last but not least, management profits from its information centers in another important manner. Because of their synoptic character, the centers are able to indicate the areas of ignorance, pointing toward desirable potential fields of future research. This has been expressed eloquently by N. A. Lange, who compiled the well-known *Handbook of Chemistry* – my main reference book in my days as an active bench chemist. In the foreword to the first (1934) edition, Dr. Lange writes:

> *...The book will be of value not only as an aid in answering the most varied questions – but also an inspiration through what it suggests by the gaps and inconsistencies, challenging as they do the incentive to engage in the creative and experimental work necessary to supply the missing information.*

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[15] Tom Bauman, "Letter from Oak Ridge – Toward a Truly National Laboratory," *Sci. Res.*, July 7, 1969, p. 15.

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